USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Surface and Subsurface Transport Pathways of Non-Point Agricultural Pollutants: Analysis of the Problem Over Four Decades of Basin Scale

Focus Categories: NPP, NC, GW

Keywords: Agriculture, Contaminant Transport, Fertilizers, Groundwater Hydrology, Groundwater Quality, Herbicides, Isotopes, Leaching, Nitrogen, Nutrients, Organic Compounds, Pollutants, Rivers, Runoff, Solute Transport, Unsaturated Flow, Water Quality

Duration: 7/1/99-6/3/01

Federal Funds Requested: $155,000

Principal Invistagor(s) name(s) and University:

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Technical Abstract

The overarching goal of the proposed research is to understand the contributions of surface and subsurface hydrologic components to non-point chemical loading of surface water, at field and basin scales, in a semi-arid dryland agricultural setting. An important contribution of this study is that it will use geochemical tracers (including isotopes) to quantify the sources of water discharge at multiple watershed scales. This work will build on previous and on-going, primarily basin-scale studies, conducted by USGS researchers as part of the NAWQA program. The improved understanding of hydrologic transport pathways gained will be used to assess the impact of current agricultural practices on the chemical loading of the shallow groundwater system.

The specific objectives of the study are:

1. To quantify field-scale occurrence and movement of an herbicide (triallate) and a nutrient (nitrate) at selected field-sites and concurrently trace transmission to local drainage ways
2. To separate hydrographs of local- to basin-scale surface-water flows into their overland, soil-water, and groundwater components, using measured compositions of multiple, independent chemical and isotopic tracers (TDS, SiO2, Cl, 18O)
3. To test the ability of the resultant models to explain observed nitrate and triallate concentrations in surface water associated with each scale;

4. To use the understanding gained to estimate the effects of non-point chemical application on the shallow groundwater resources at field and basin scales.

These objectives will be met through the analysis of triallate and nitrate concentrations and water discharges in surface runoff, soil solution, groundwater, tile drawing water, and concurrent drainage for two particular fields. 'Upscaling' of the mixing model relationships developed at the field scale will be tested through monitoring of discharge at watershed scales up to the river-basin scale (6.5x10^5 ha) at regular intervals over a water year. Because the study focuses on the processes which control transport, the information gained will provide insights on the fate of other chemicals with similar physicochemical properties. We anticipate that the methods developed will be useful in other basins studied in the USGS NAWQA program.

To achieve the objectives, we have assembled an interdisciplinary and uniquely qualified inter-agency team including faculty members from Washington State University, USDA and USGS researchers, and engineers.

The proposed project will provide training for four WSU (1 each undergraduate, M.S., Ph.D., and post doctoral) students. These students will experience the benefits of interdisciplinary advising teams. The results of this quantitative and hypothesis-driven study will be published in internationally recognized journals and communicated to PBAC and local water purveyors via channels already established by the PIs.